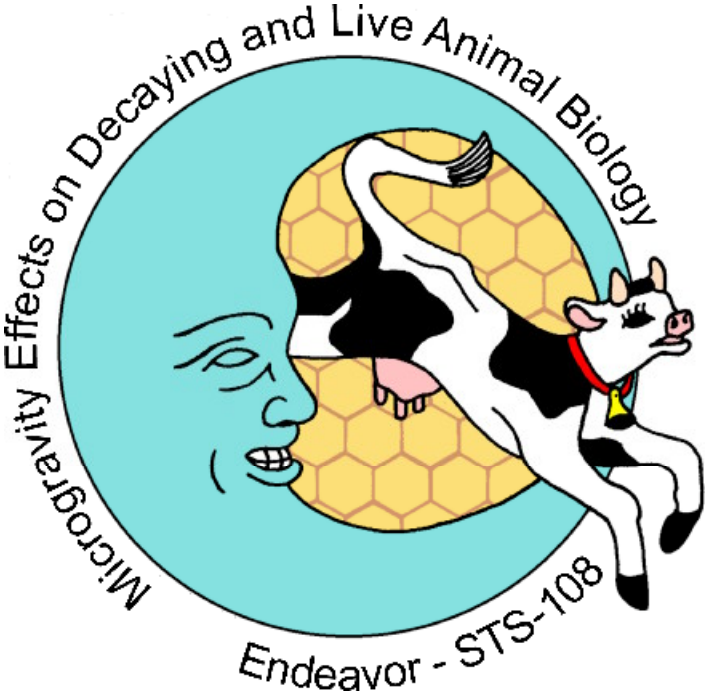


SEM-15
MEDLAB

Guardian Lutheran School
Dearborn, Michigan

Table of Contents

Experiment Purpose

The purpose of the experiment is to study the effects on animal tissue in space. By studying animal tissues, the students will hopefully gain insight as to the effects of space travel on mankind, as well as his traditional food sources. Will humans be able to have alternatives to vegetarian and/or preserved earth foods? Based on the success of the experiment, we also hope to gain insight on possible preservation techniques.

It is important to test in micro gravity because today's technology can duplicate or mimic every other force of nature while in space, except gravity. We do not encourage our students to develop a hypothesis prior to experimentation. We encourage them to ask questions: What happens when…? or What is the difference between…? or What is the effect of … on…?

The true value of the experiment is two-fold. First it will help them develop their cognitive and communication skills, by engaging in true investigative study, without preconceived notions of the outcome. Secondly, it will spark the students imagination, and give them a starting point to examine and appreciate the frailty of life.

Procedure

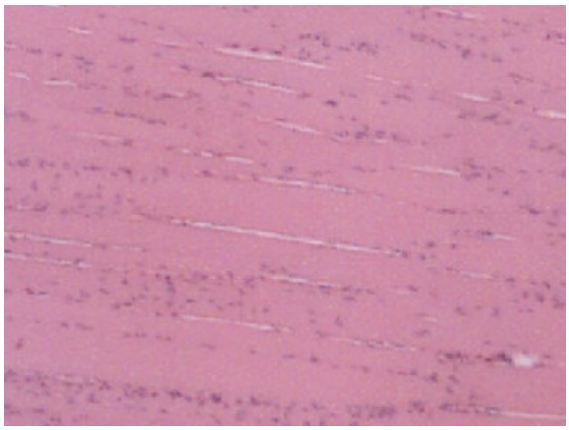
1. Twenty one biological samples were collected by the second and third grade students and their parents.
2. Guardian Lutheran School Elementary Science teacher, Mrs. Polonky, and our program mentor, Mr. Frey helped to prepare the samples. Each sample was put into Space Capsules provided by NASA. The “wet” samples were packaged in honey, as an attempt to preserve the samples naturally. The “dry” samples were packaged without any preservative.
3. Each Space Capsule was weighed by the second grade class.
4. The samples were sent to NASA, and flown on STS-108 as part of Space Experiment Module SEM-15.
5. The experiment was in microgravity for twelve days.
6. The samples were returned to Guardian Lutheran School, and weighed again by the second grade class.
7. The samples were then sent to Henry Ford Hospital to be processed into microscope slides and whole organism castings.
8. The slides were examined by the third grade class.

Observations

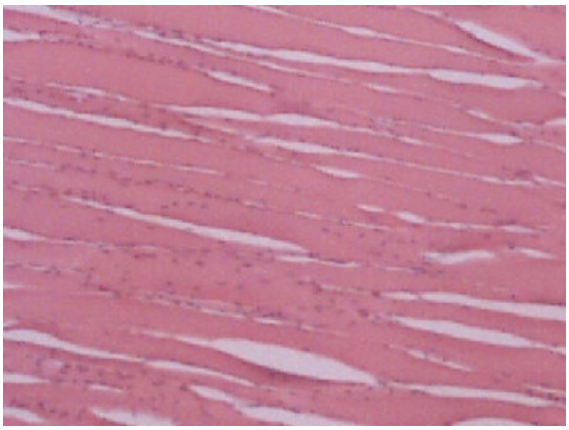
Weight of Samples

Vial No.	Item	Pre-flight Weight (Grams)	Post-flight Weight (Grams)
1	Muscle - Bovine (Beef)	63.26	62.30
2	Muscle - Swine (Pork)	62.17	61.01
3	Muscle - Fowl (Chicken)	64.00	63.86
4	Muscle - Fish (Catfish)	62.21	61.60
5	Liver - Bovine (Beef)	61.86	61.25
6	Liver - Fowl (Chicken)	63.19	62.90
7	Skin - Fowl (Chicken)	63.72	63.62
8	Bone - Bovine (Beef)	65.10	65.09
9	Bone - Swine (Pork)	65.37	65.32
10	Bone - Fowl (Chicken)	63.36	63.32
11	Bone - Fish (Catfish)	63.88	63.84
12	Blood - Human (Donated by Dad)	36.52	36.11
13	Hair - Human (Donated by Me)	30.56	30.81
14	Whole Organism - Protozoa (Pond Water)	53.58	53.15
15	Whole Organism - Insect (Crickets)	62.50	62.42
16	Whole Organism - Invertebrate (Earthworms)	64.69	64.66
17	Whole Organism - Mollusk (Snails)	65.91	65.88
18	Whole Organism - Cold-blooded Vertebrate (Fish)	64.63	64.61
19	Whole Organism - Warm-blooded Vertebrate (Mouse)	61.75	61.60
20	Whole Organism - Metamorphic (Tadpole)	64.96	64.95
21	Whole Organism - Cryptobiotic (Brine Shrimp Eggs)	37.08	37.60
22	Scale Calibration - Control Sample (Plain Honey)	64.73	64.73

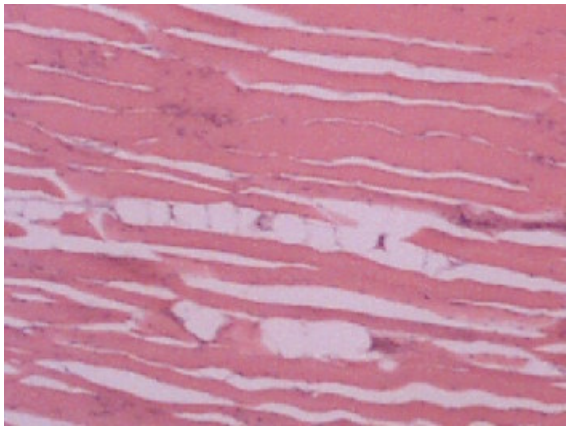
Visual Comparisons



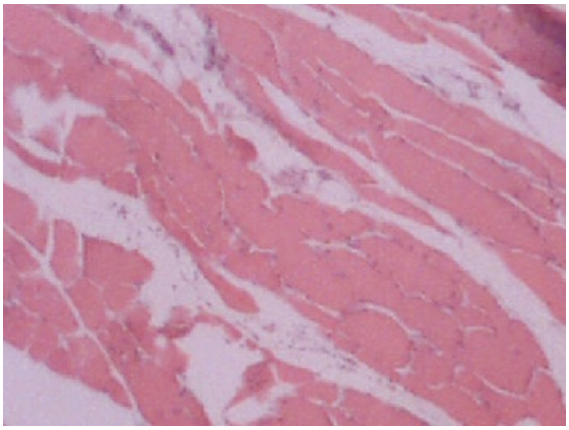
Vial 1 (Control)
Muscle – Bovine (Beef)
200x Magnification



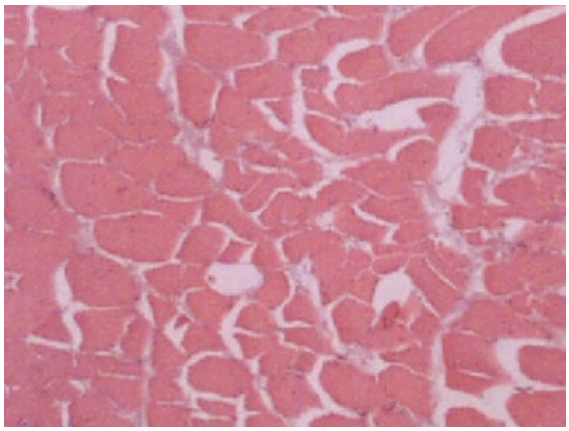
Vial 1 (Exposed to Microgravity in space)
Muscle – Bovine (Beef)
200x Magnification



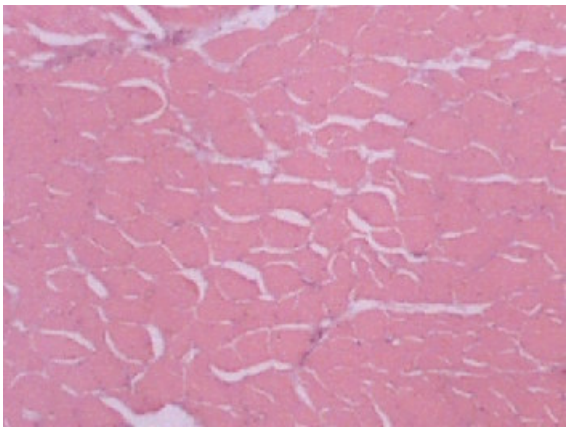
Vial 2 (Control)
Muscle – Swine (Pork)
200x Magnification



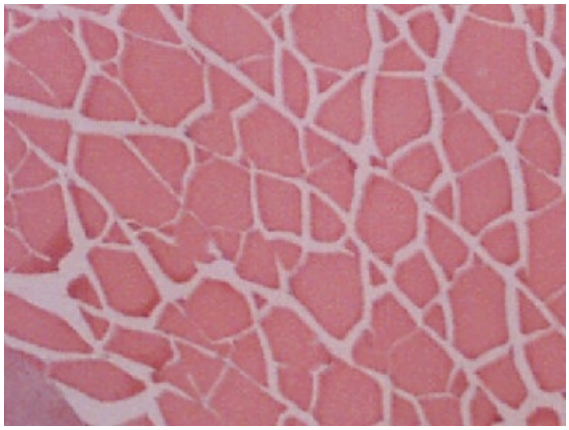
Vial 2 (Exposed to Microgravity in space)
Muscle – Swine (Pork)
200x Magnification



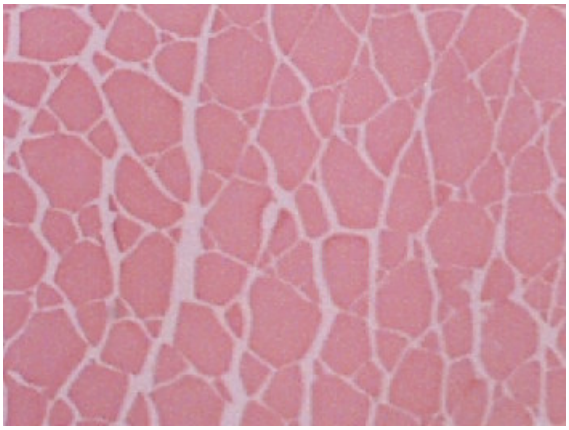
Vial 3 (Control)
Muscle – Fowl (Chicken)
200x Magnification



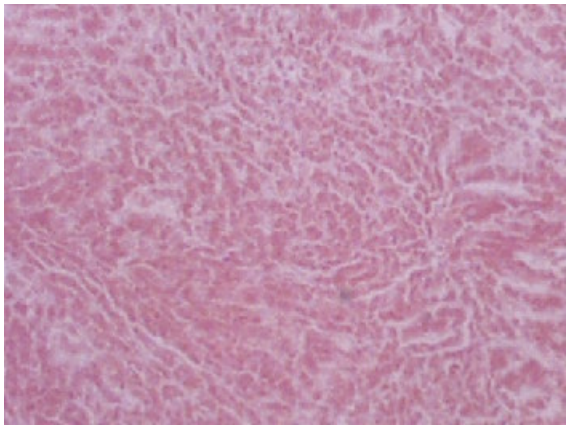
Vial 3 (Exposed to Microgravity in space)
Muscle – Fowl (Chicken)
200x Magnification



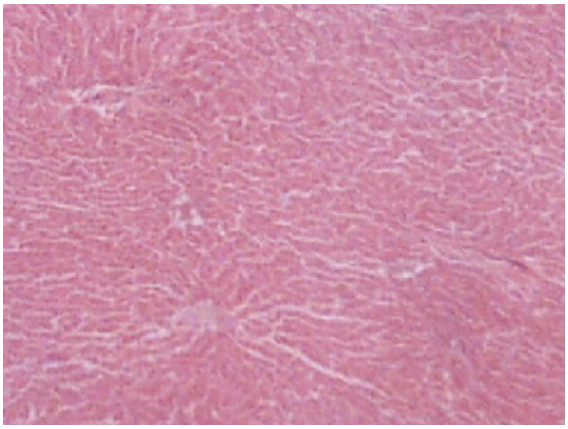
Vial 4 (Control)
Muscle – Fish (Catfish)
200x Magnification



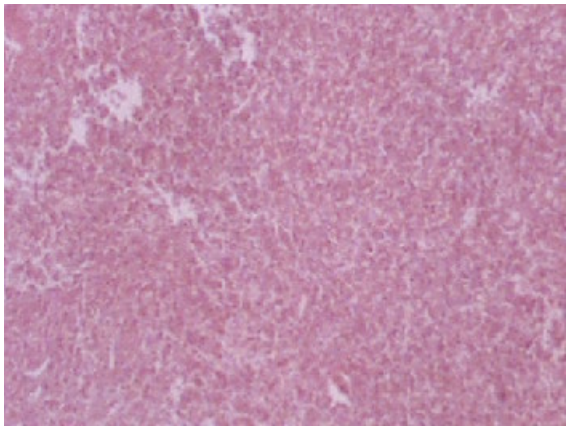
Vial 4 (Exposed to Microgravity in space)
Muscle – Fish (Catfish)
200x Magnification



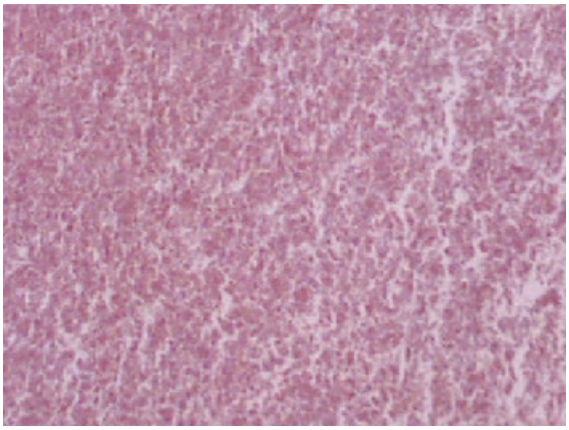
Vial 5 (Control)
Liver – Bovine (Beef)
200x Magnification



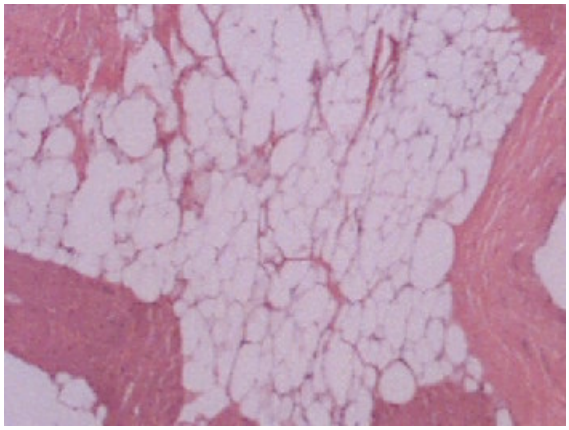
Vial 5 (Exposed to Microgravity in space)
Liver – Bovine (Beef)
200x Magnification



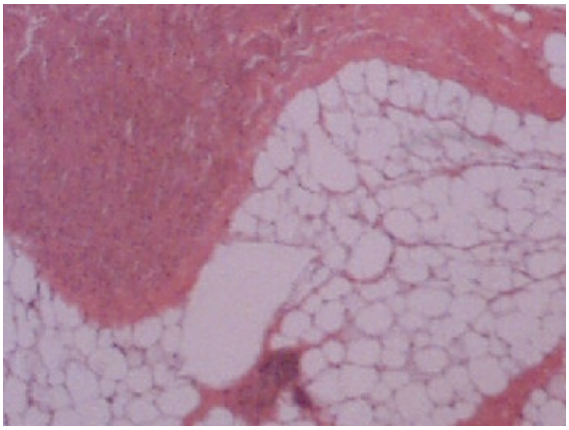
Vial 6 (Control)
Liver – Fowl (Chicken)
200x Magnification



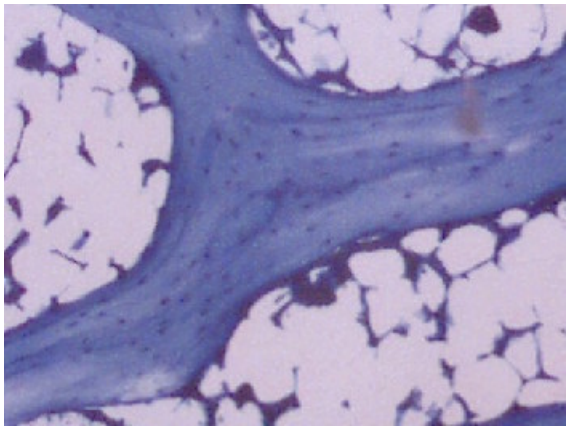
Vial 6 (Exposed to Microgravity in space)
Liver – Fowl (Chicken)
200x Magnification



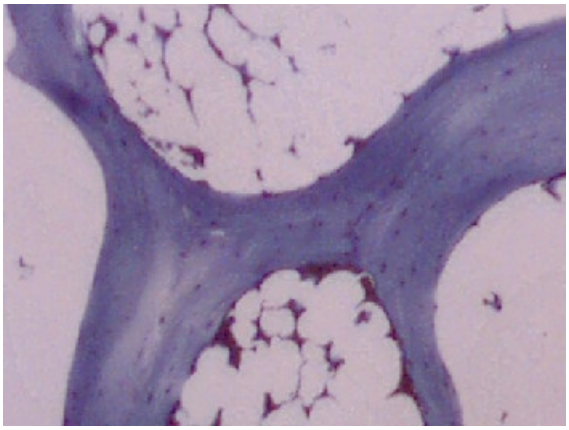
Vial 7 (Control)
Skin – Fowl (Chicken)
200x Magnification



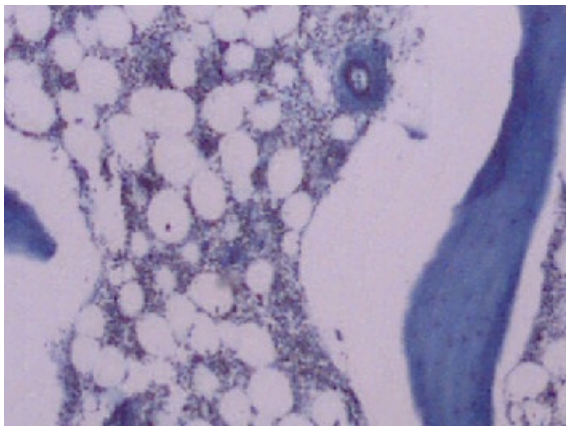
Vial 7 (Exposed to Microgravity in space)
Skin – Fowl (Chicken)
200x Magnification



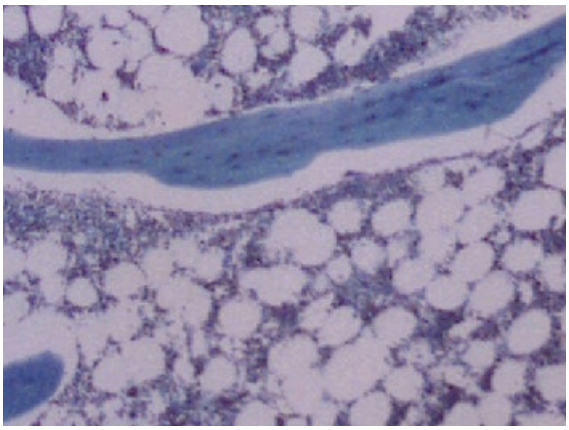
Vial 8 (Control)
Bone – Bovine (Beef)
200x Magnification



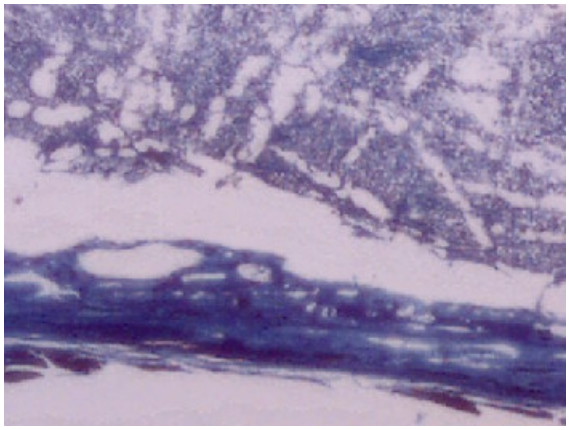
Vial 8 (Exposed to Microgravity in space)
Bone – Bovine (Beef)
200x Magnification



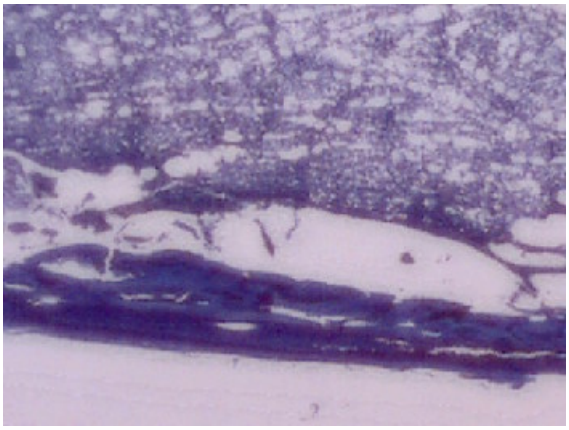
Vial 9 (Control)
Bone – Swine (Pork)
200x Magnification



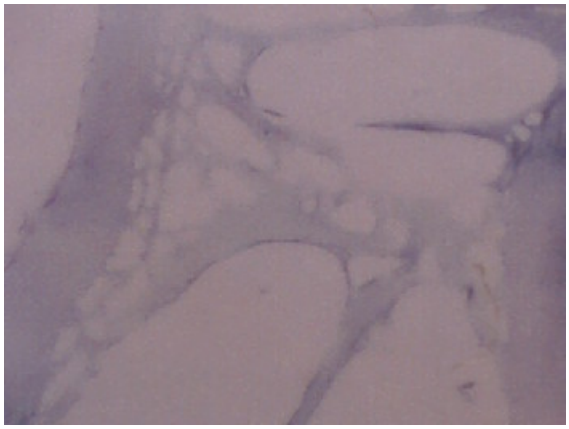
Vial 9 (Exposed to Microgravity in space)
Bone – Swine (Pork)
200x Magnification



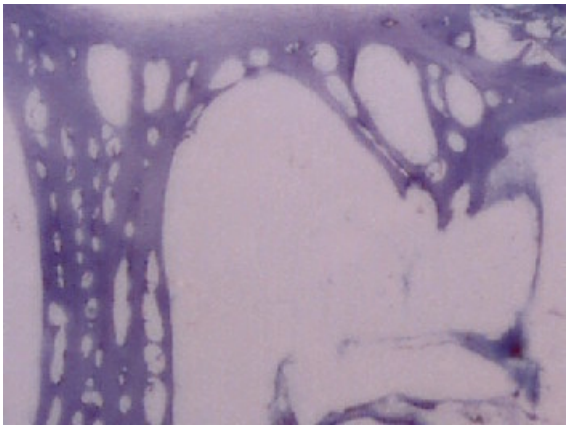
Vial 10 (Control)
Bone – Fowl (Chicken)
60x Magnification



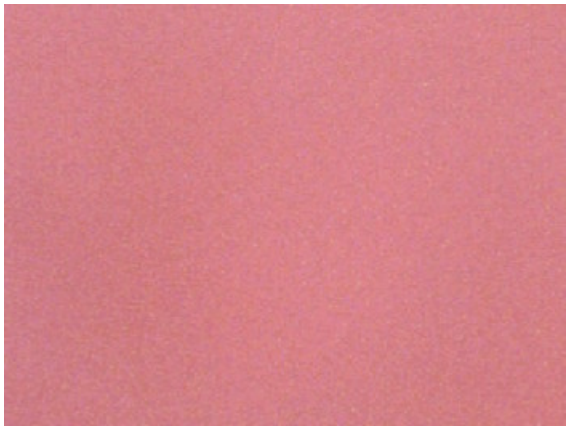
Vial 10 (Exposed to Microgravity in space)
Bone – Fowl (Chicken)
60x Magnification



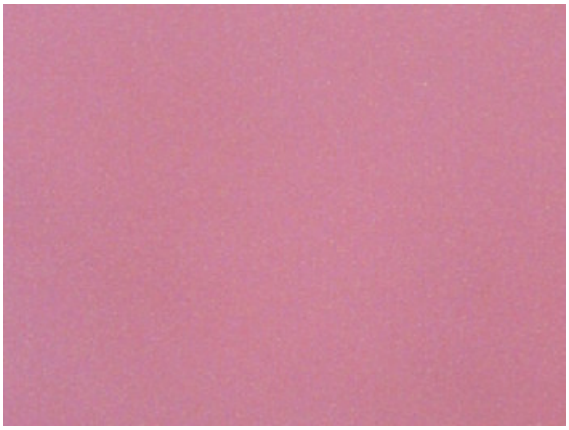
Vial 11 (Control)
Bone – Fish (Catfish)
60x Magnification



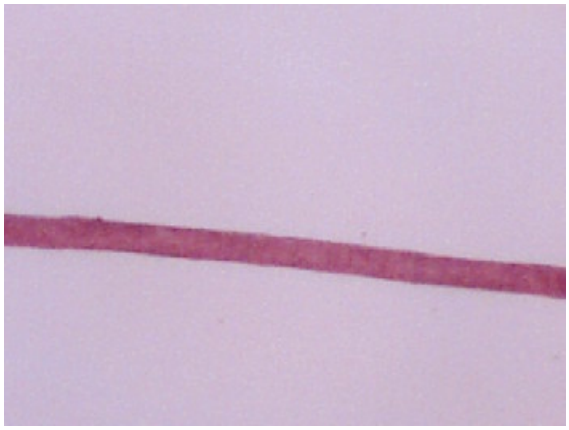
Vial 11 (Exposed to Microgravity in space)
Bone – Fish (Catfish)
60x Magnification



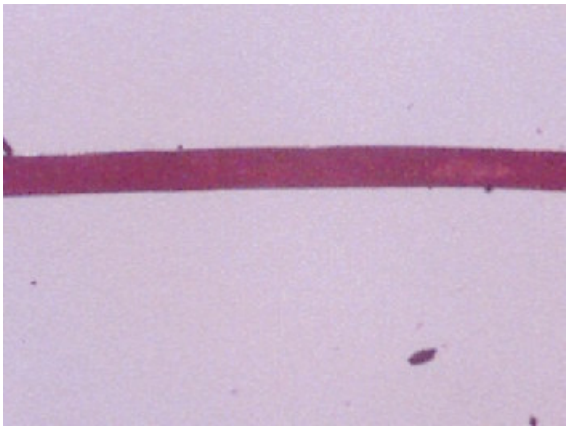
Vial 12 (Control)
Blood – Human (Dad's)
200x Magnification



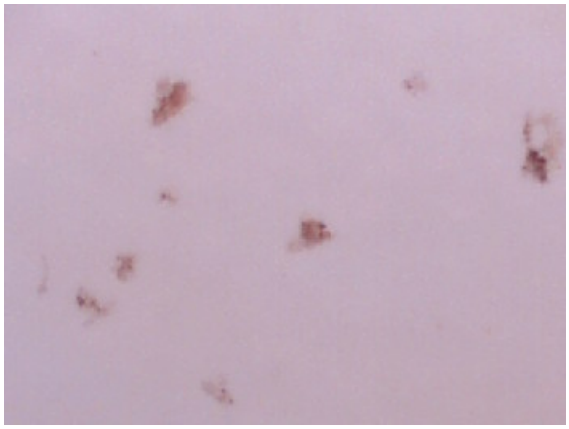
Vial 12 (Exposed to Microgravity in space)
Blood – Human (Dad's)
200x Magnification



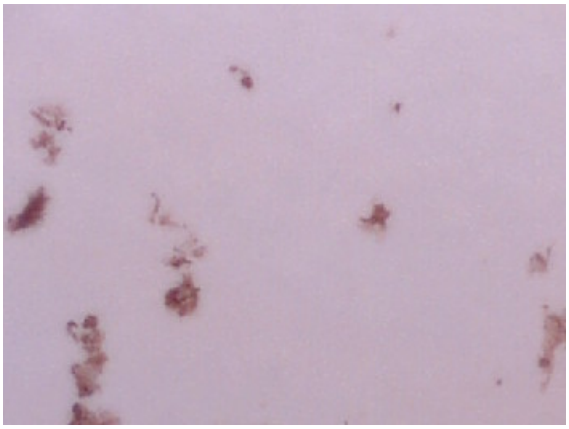
Vial 13 (Control)
Hair – Human (Mine)
200x Magnification



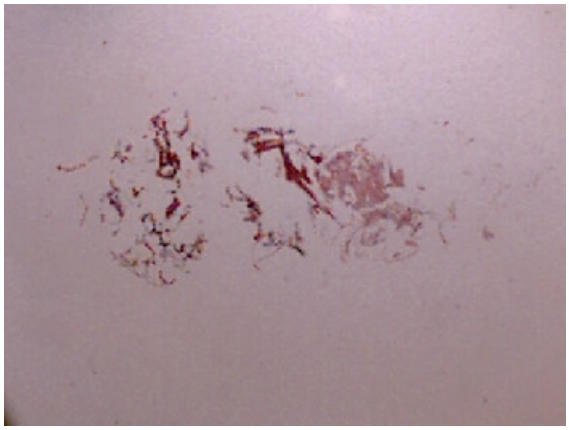
Vial 13 (Exposed to Microgravity in space)
Hair – Human (Mine)
200x Magnification



Vial 14 (Control)
Protozoa (Pond Water)
200x Magnification

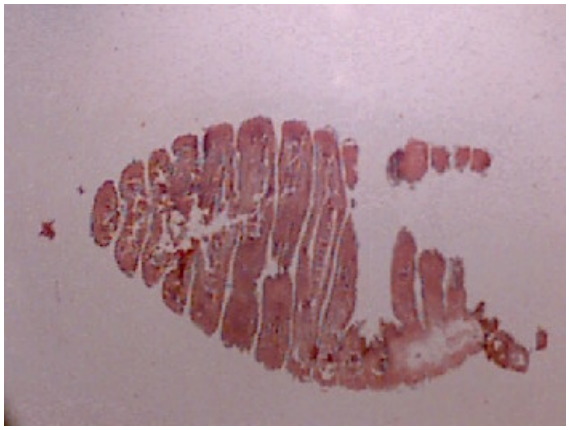


Vial 14 (Exposed to Microgravity in space)
Protozoa (Pond Water)
200x Magnification

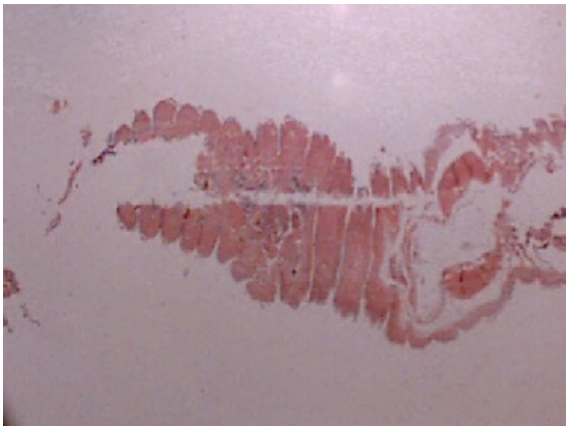


Vial 15 (Control)
Insect (Cricket)
10x Magnification

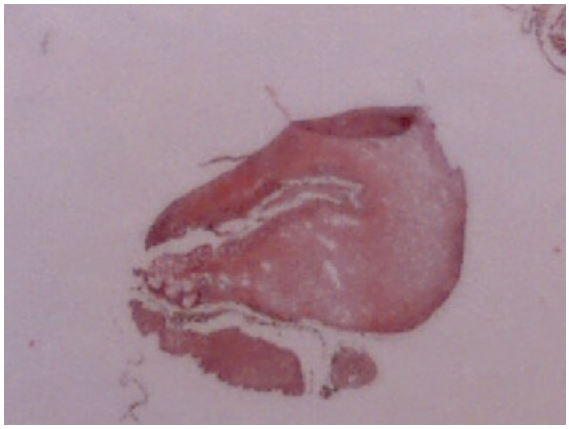
Vial 15 (Exposed to Microgravity in space)
Insect (Cricket)
10x Magnification



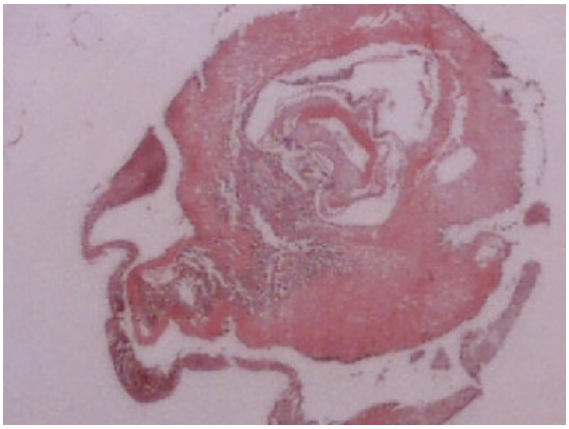
Vial 16 (Control)
Invertebrate (Earthworm)
10x Magnification



Vial 16 (Exposed to Microgravity in space)
Invertebrate (Earthworm)
10x Magnification



Vial 17 (Control)
Mollusk (Snail)
60x Magnification



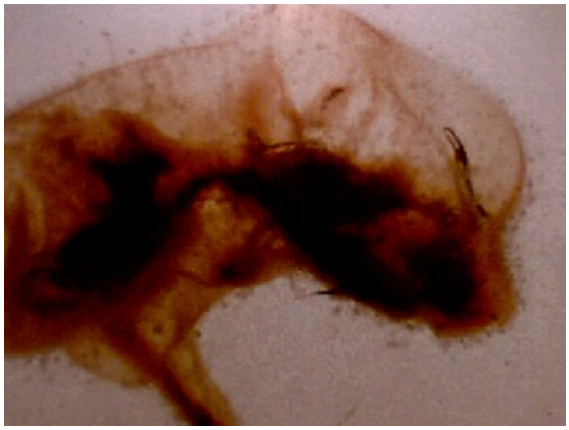
Vial 17 (Exposed to Microgravity in space)
Mollusk (Snail)
60x Magnification

SAMPLE DESTROYED

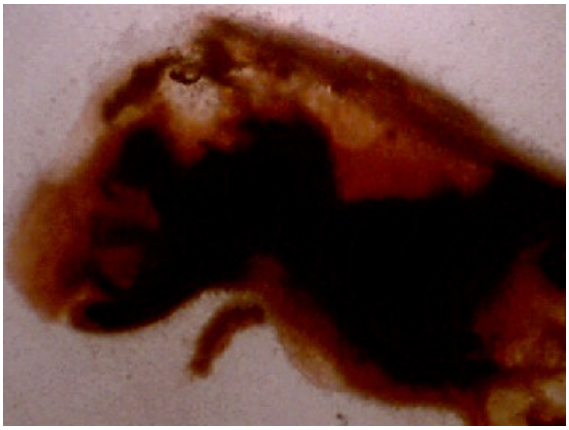
Vial 18 (Control)
Cold-blooded Vertebrate (Fish)

NO COMPARISON MADE

Vial 18 (Exposed to Microgravity in space)
Cold-blooded Vertebrate (Fish)



Vial 19 (Control)
Warm-blooded Vertebrate (Mouse)
10x Magnification



Vial 19 (Exposed to Microgravity in space)
Warm-blooded Vertebrate (Mouse)
10x Magnification

NO COMPARISON MADE

SAMPLE DESTROYED

Vial 20 (Control)
Metamorphic (Tadpole)

Vial 20 (Exposed to Microgravity in space)
Metamorphic (Tadpole)

NO COMPARISON MADE

SAMPLE DESTROYED

Vial 21 (Control)
Cryptobiotic (Brine Shrimp Eggs)

Vial 21 (Exposed to Microgravity in space)
Cryptobiotic (Brine Shrimp Eggs)

Conclusion

Through our studies, we have learned that living things, like the astronauts, go through changes while they are in space. Their bodies do not have to work as hard, so they get weaker. Our experiment on the effects of microgravity on decaying and live animal biology shows that decaying biology, like fresh food (meat), does not go through any change in microgravity. This would indicate that food storage techniques in space, do not need to be any different than on Earth.

Furthermore, it is interesting to note that even though the samples were stored at room temperature for several months before processing, the amount of decay was negligible. Many students have expressed interest in additional experiments, exploring the use of honey as a natural preservative here on Earth, as well as space.

Application

Our experiment and research are useful in many ways. We have learned that astronauts will be able to store food the same ways we store it on Earth. Also, the astronauts' bodies change in space, but with exercise and vitamins, they can stay healthy. Also, we can have jails in space, so that we would not have to have any on Earth.

Acknowledgments

We would like to thank Mr. Frey for designing our project and for all his help coordinating the efforts of students, parents, NASA and Henry Ford Hospital.

We would like to thank NASA for sponsoring the Space Experiment Module program for students, and Mr. Brodell at NASA for accepting our application and getting our experiment onto the Space Shuttle.

We would like to thank Mrs. Spence and Dr. Les at Henry Ford Hospital for processing all of our samples and making microscope slides and castings of them.